CARDIAC DEVICE MANAGEMENT

A patient's PPM is programmed VVIR 60 – 130 bpm

Their PPM will pace:

1. Pace both atrium and ventricle at 70 bpm
2. Pace the atrium
3. Pace the ventricle
4. Not pace

Pacemaker Mode

- Defines the chambers that are paced/sensed
- Defines how the pacemaker will respond to intrinsic events
- Defines if rate modulation is available (i.e., DDDR)

NBG Code – The Usual Pacing Modes

I	II	III	IV	V
Chamber(s) Paced	Chamber(s) Sensed	Response to Sensing	Rate Modulation	Multisite Pacing
O = None	**O** = None	**O** = None	**O** = None	**O** = None
A = Atrium	**A** = Atrium	**T** = Triggered	**R** = Rate modulation	**A** = Atrium
V = Ventricle	**V** = Ventricle	**I** = Inhibited		**V** = Ventricle
D = Dual (A + V)	**D** = Dual (A + V)	**D** = Dual (T + I)		**D** = Dual (A + V)
S = Single (A or V)	**S** = Single (A or V)			

- Examples
  - DDD
  - DDDR
  - DDIR

– VVI

– VVIR

– AAI

Capture

Depolarization of cardiac muscle
following an electrical stimulus
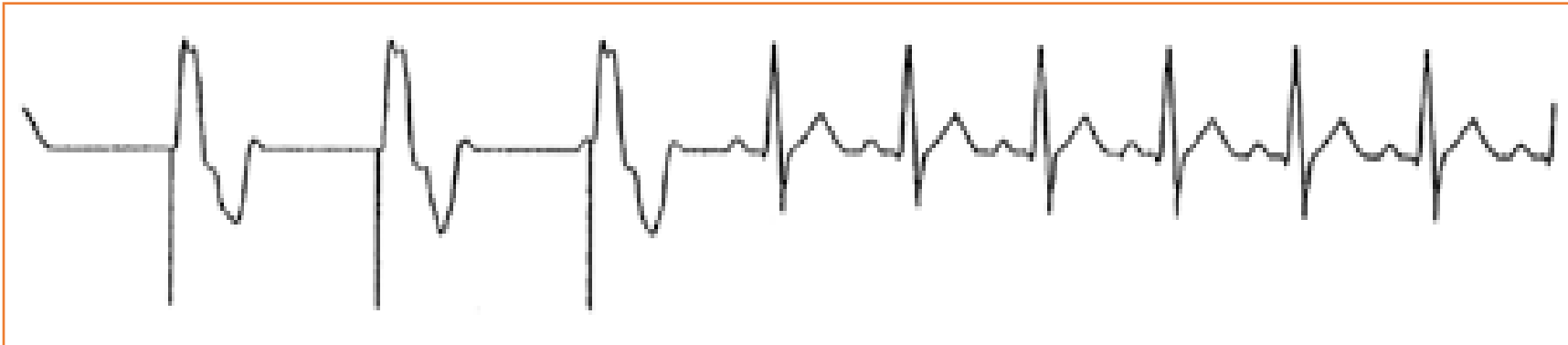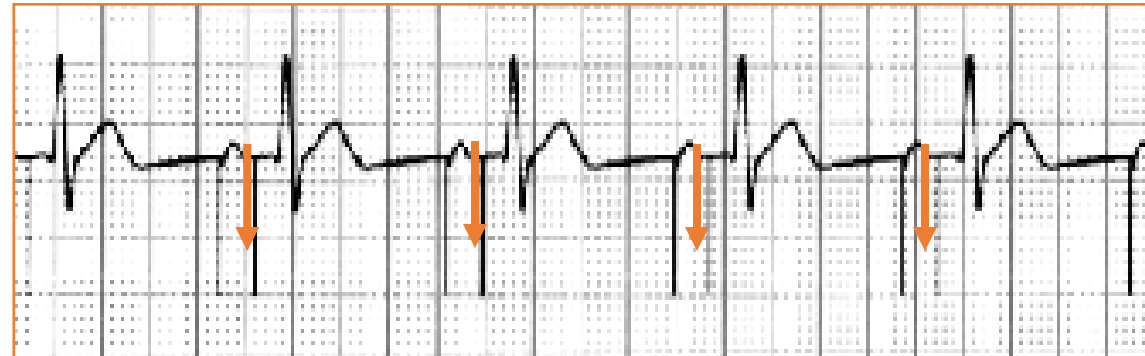
Stimulation Threshold

The minimum output pulse needed
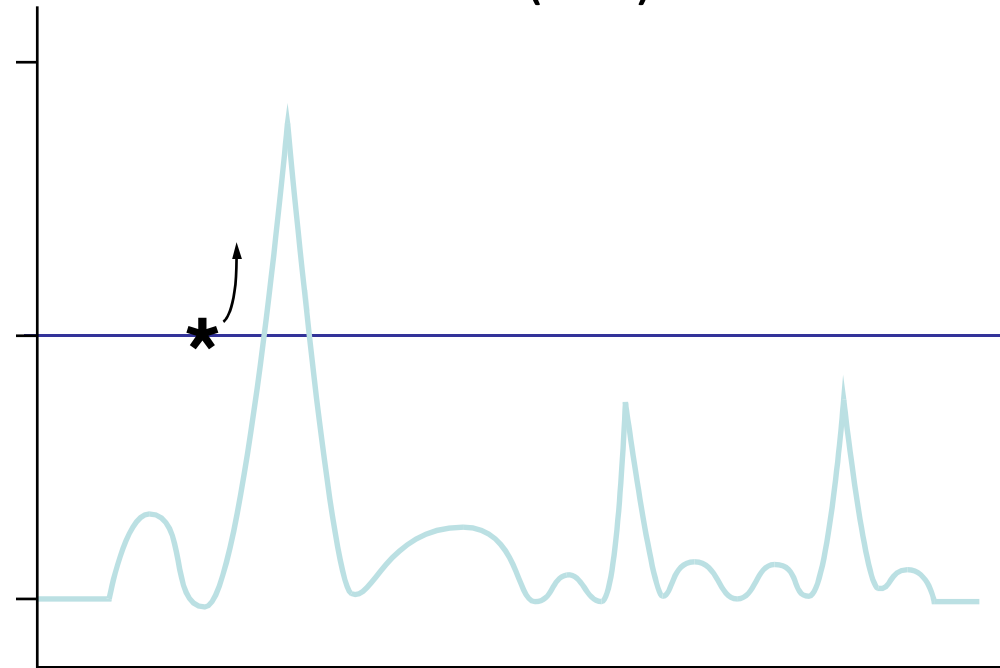to consistently capture the heart

Capture

Loss of Ventricular Capture

Setting Sensitivity

The degree that the pacing system "sees" or senses signals, controlled by the sensitivity setting which is graduated in millivolts (mV)
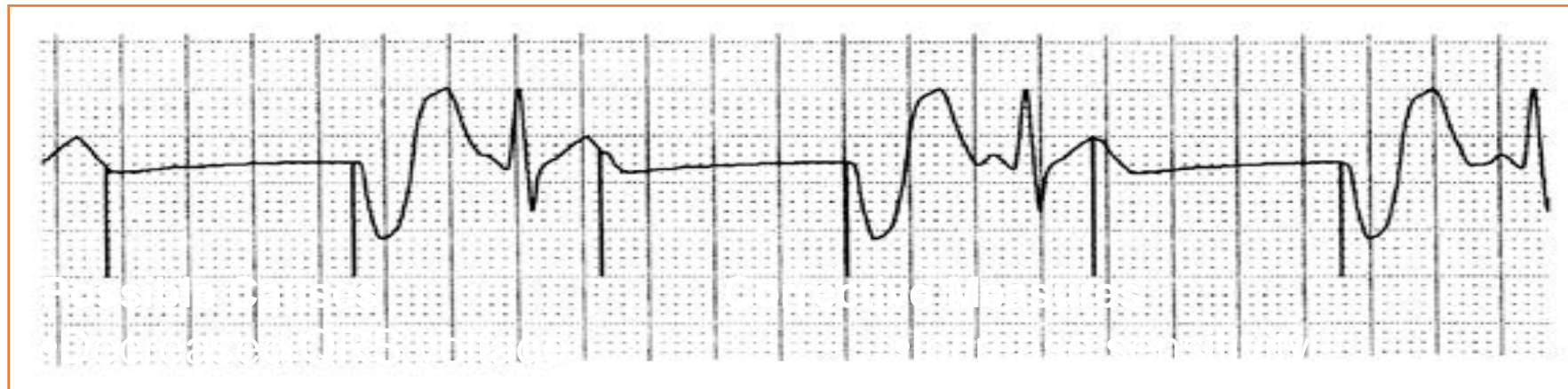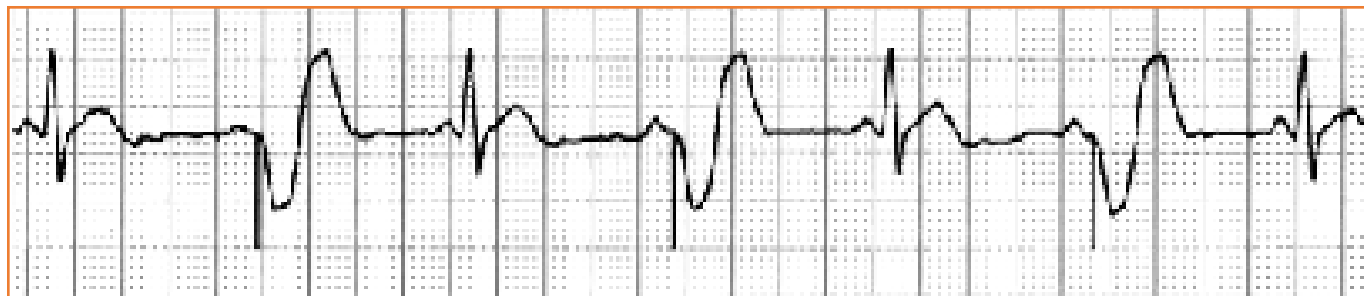

at least a 2:1 safety margin

Undersensing

Failure of the pacemaker to sense
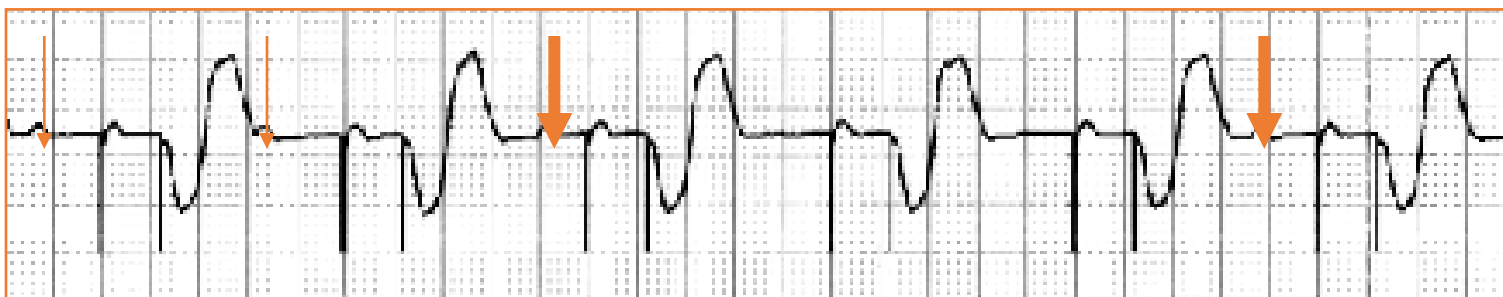intrinsic R-waves or intrinsic
P-waves
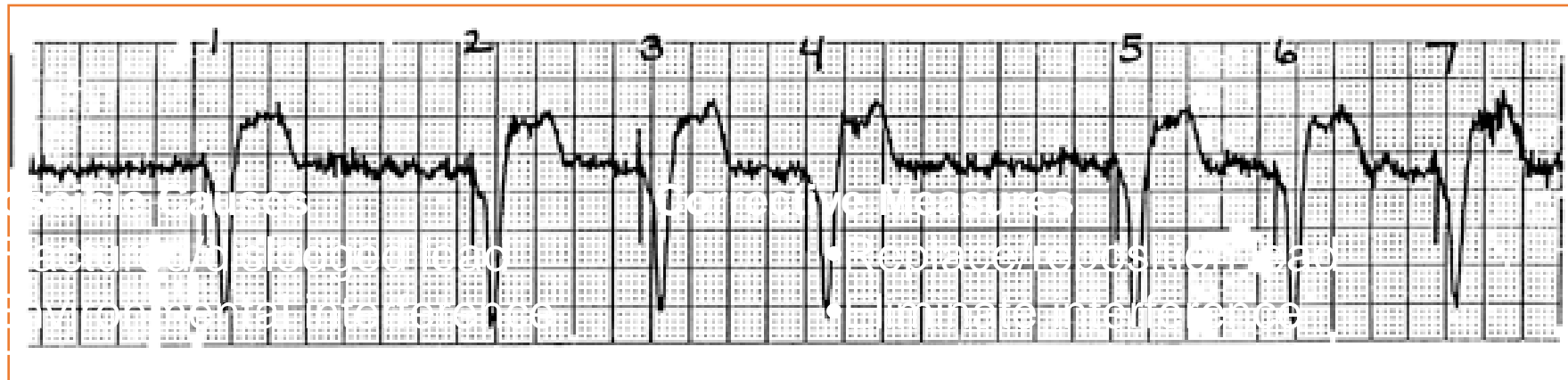
Undersensing

Sensing

Atrial Undersensing

Oversensing

Inhibition of the pacemaker by events pacemaker should ignore, e.g. EMI, T-waves and myopotentials

Oversensing

A patient has a PPM programmed in the DDD mode and a magnet is applied

Their PPM will :

1. Pace both atrium and ventricle asynchronously

2. Pace the atrium asynchronously

3. Pace the ventricle asynchronously

4. Not pace

Magnet Response PPM and ICD

Magnet Interactions for PPM

- Pacemaker Magnet Function
  - Paces the patient without sensing (DOO, VOO)

  - No audible tones from pacemakers
    - If you hear a tone the device is not a PM

  - Once magnet is removed the device returns to original programming

Magnet Application to PPM
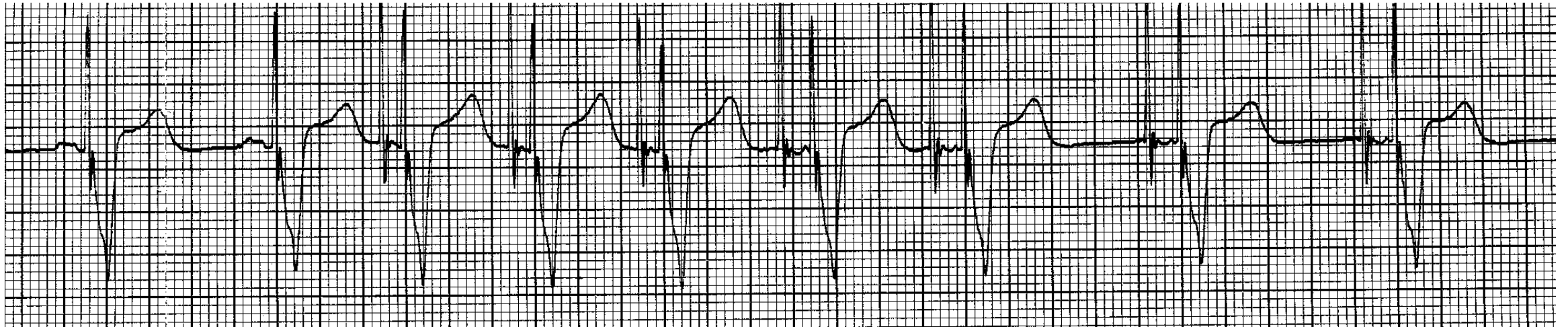
Magnet Application on ICDs

- Placing a magnet over an Implantable Cardioverter Defibrillator (ICD) will suspend Tachycardia Detection.

- With detection suspended, the ICD will not deliver any tachycardia or fibrillation therapies.

- Pacing support will not be affected.

Magnet Application on ICDs

- Once the magnet is removed, the ICD will return to normal operation.

- The need for suspending detection may arise due to risk of inappropriate therapy from erroneous noise (electrocautery) or oversensing (T wave oversensing).
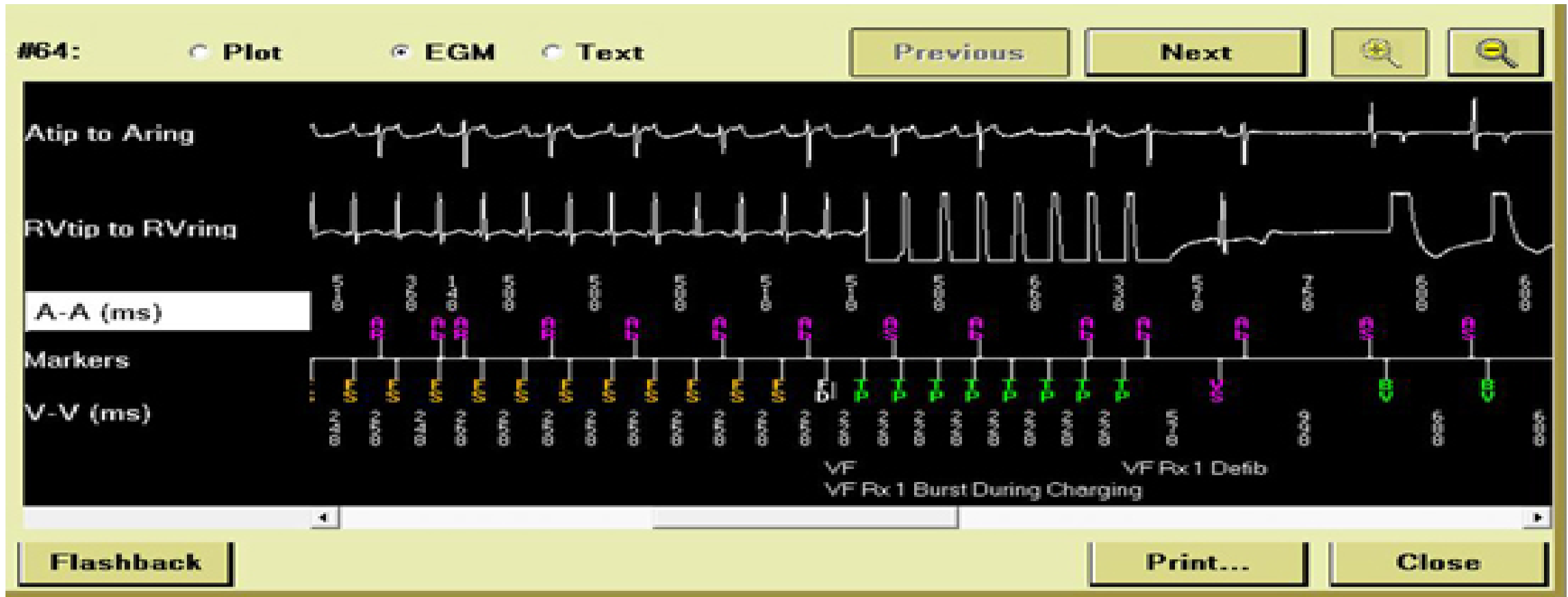
ICD + Magnet = No Shocks

PM + Magnet = Async pacing 85 bpm

ICD THERAPIES

- There are four types of therapies available in an ICD:
  - Bradycardia pacing
  - Antitachycardia pacing (ATP)
  - Cardioversion
  - Defibrillation

A patient has this recorded event:

This is an example of:

1. Pace both atrium and ventricle at 70 bpm
2. ATP in the the atrium
3. ATP in the ventricle
4. Not pace

Antitachycardia pacing
# (ATP)

Antitachycardia pacing (ATP)

LOW POWER

- Fast pacing pulses delivered to the heart through the lead to interrupt the reentrant circuit of an arrhythmia

- Provides pain free therapy

- Different types available (i.e. Burst, Ramp)
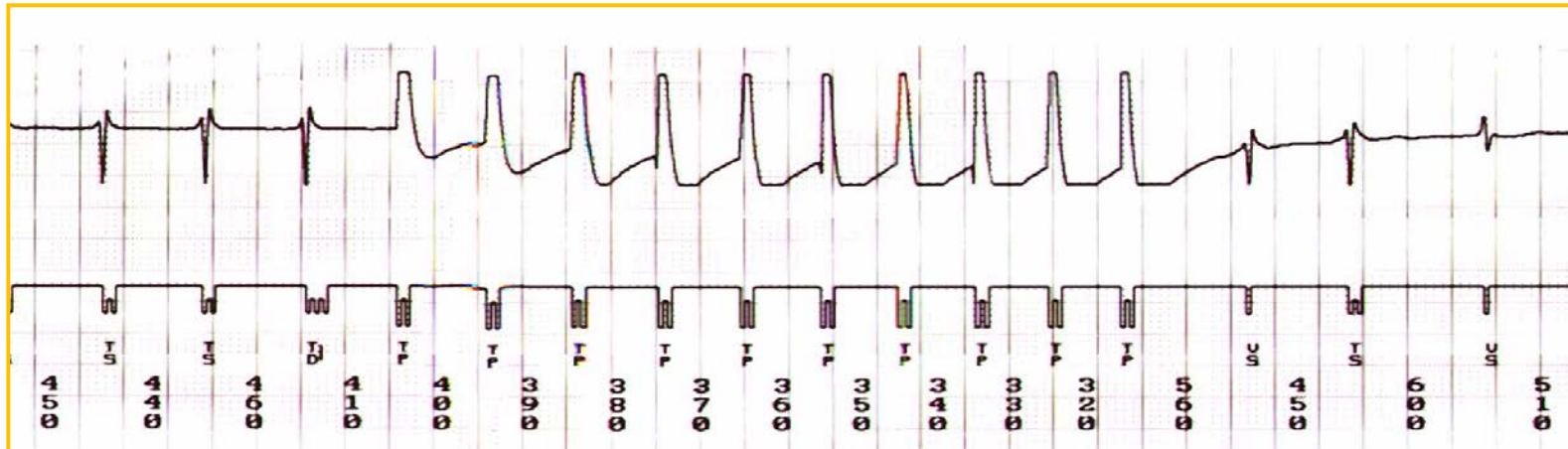
# Cardioversion

Cardioversion (CV) – High power

- Delivered for VT and Fast VT episodes
- A cardioversion (CV) is always synchronized and delivered on a R-wave.
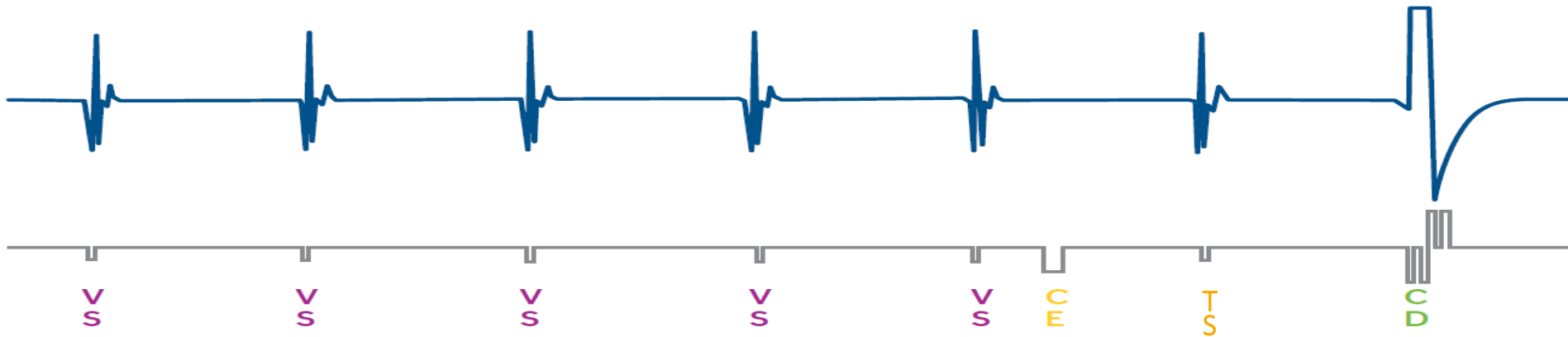
Defibrillation
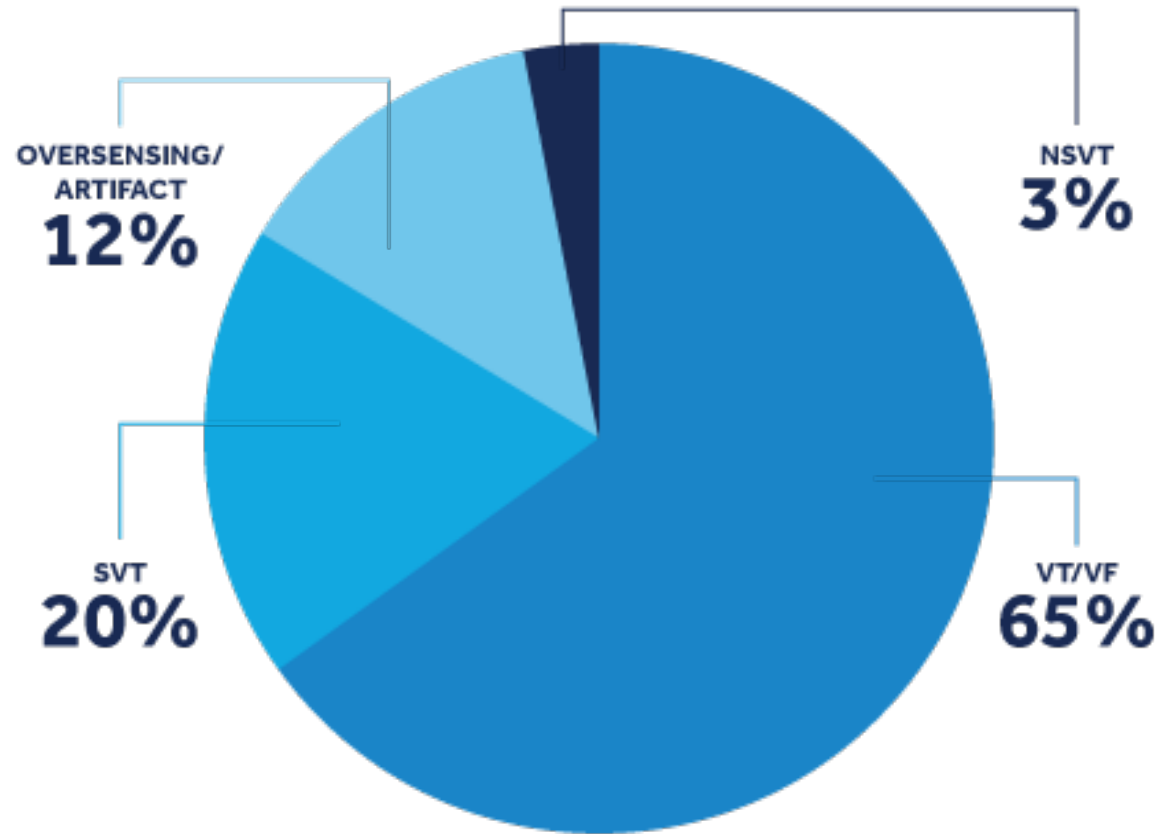## shock

Defibrillation Shock

- Used in the treatment of ventricular fibrillation which is unorganized and often the result of many reentrant circuits.

- The ICD attempts to synchronize the shock to an R-wave first, but **will** deliver the shock regardless of whether the synchronization is successful.
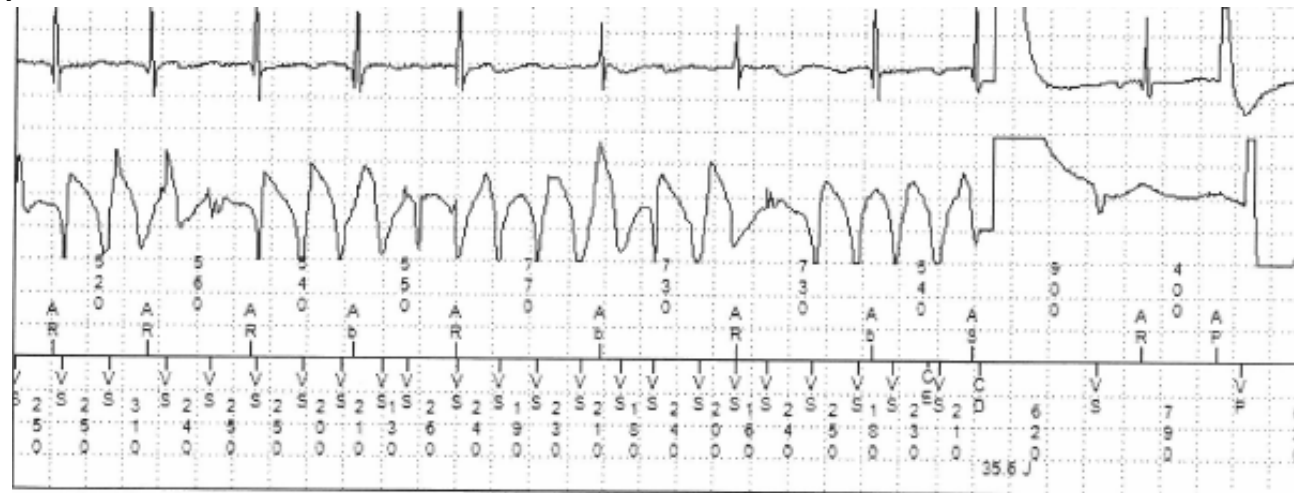
Causes and Solutions for Inappropriate Shocks
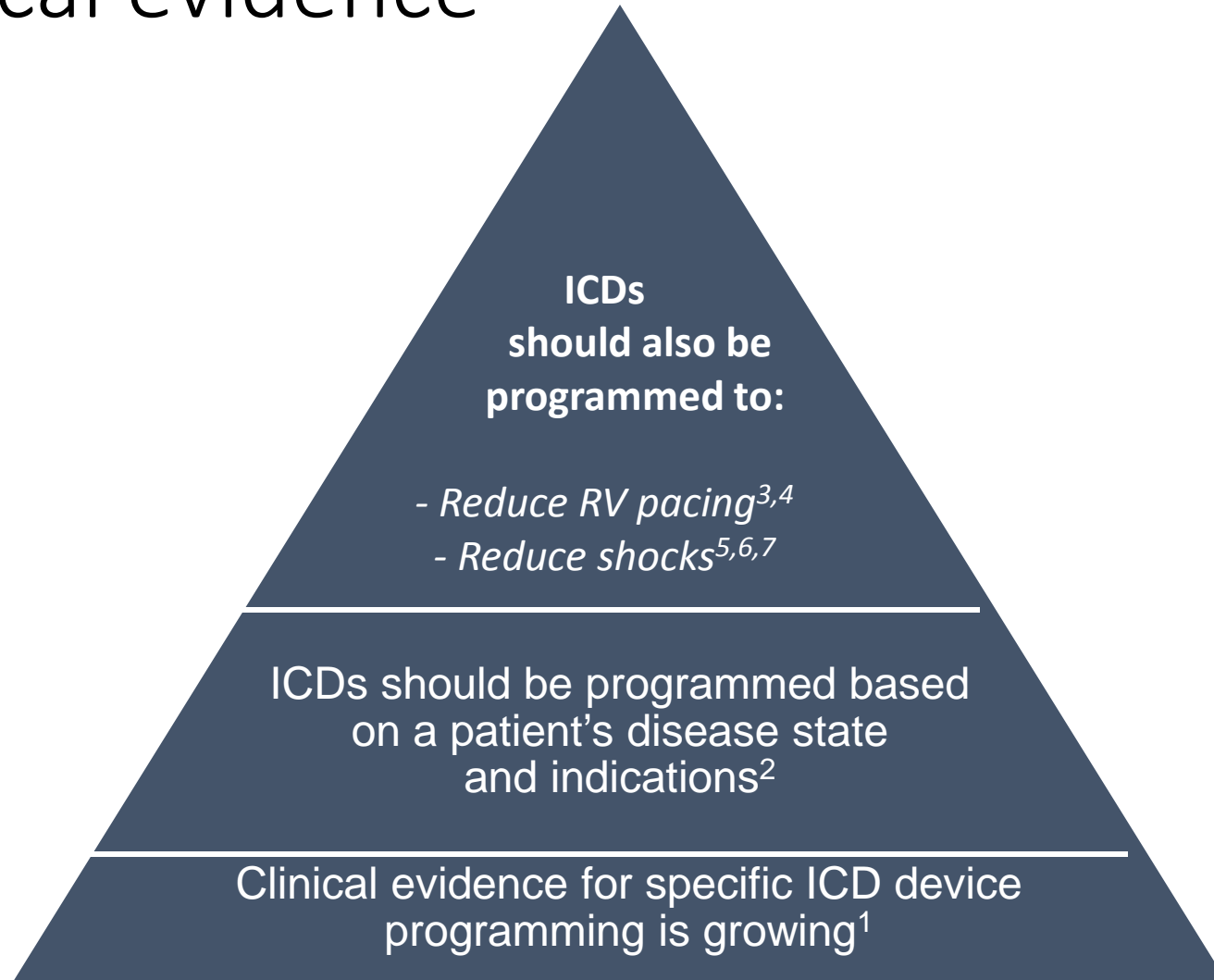
Causes of shocks

- Approximately 65% of shocks are treating true arrhythmias.[14]

- On average in the primary prevention patient population, 35% of shocks are inappropriate.[14]

OVERSENSING/ ARTIFACT **12%**

NSVT **3%**

SVT **20%**

VT/VF **65%**

The importance of ICD shock reduction

- Pain

- Psychiatric

- Battery

- Pro-arrhythmia

Clinical evidence

ICDs should also be programmed to:

- Reduce RV pacing[3,4]
- Reduce shocks[5,6,7]

ICDs should be programmed based on a patient's disease state and indications[2]

Clinical evidence for specific ICD device programming is growing[1]

The End